

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
an insulating film formed on a substrate provided
with a transistor and having an opening portion;
5 a conductive film formed in the opening portion; and
a capacitor formed on the conductive film and
comprising a first electrode, a ferroelectric film and a
second electrode;
wherein the ferroelectric film includes at least one
element selected from the group consisting of lead, barium
and bismuth and formed from above the first electrode to
above the insulating film;
wherein a reaction barrier film is provided between
the interlayer insulating film and the ferroelectric film;
15 wherein a diffusion barrier film is provided between
the conductive film and the first electrode and side faces
of the diffusion barrier film are not brought into contact
with the ferroelectric film; and
wherein side faces of the first electrode are
20 provided to be brought into contact with the ferroelectric
film.

2. The semiconductor device according to Claim 1:
wherein the ferroelectric film comprises any of the
25 group consisting of lead titanate zirconate, lead titanate,
barium lead titanate zirconate, barium lead niobate,
strontium bismuth tantalite, bismuth titanate and barium
strontium titanate zirconate.

3. The semiconductor device according to Claim 1:
wherein the reaction barrier layer comprises any of
the group consisting of titanium oxide, alumina and bismuth
5 silicate.

4. The semiconductor device according to Claim 1:
wherein the diffusion barrier film is a film
comprising any of or laminated with any of the group
10 consisting of Ti, Ta, TiN, $Al_xTi_{1-x}N$ and WN.

5. A dynamic random access memory having the
semiconductor device according to any of Claims 1 through
4 as a basic unit.

15 6. An involatile memory having the semiconductor
device according to any of Claims 1 through 4 as a basic
unit.

20 7. A semiconductor device comprising:
a substrate provided with a transistor;
an insulating film formed on the substrate and having
an opening portion;
25 a conductive film formed in the opening portion; and
a capacitor formed on the conductive film and
comprising a first electrode, a ferroelectric film and a
second electrode;
wherein the ferroelectric film includes at least one

element selected from the group consisting of lead, barium and bismuth and formed on an upper face and side faces of the first electrode and on the insulating film;

5 wherein a reaction barrier film is provided between the interlayer insulating film and the ferroelectric film;

and

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wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the reaction barrier film.

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8. The semiconductor device according to Claim 7: wherein side faces of the diffusion barrier film are not brought into contact with the ferroelectric film.

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9. The semiconductor device according to Claim 7: wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

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10. The semiconductor device according to Claim 7: wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

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11. The semiconductor device according to Claim 7: wherein the diffusion barrier film is a film

comprising any of or laminated with any of the group consisting of Ti, Ta, TiN, $Al_xTi_{1-x}N$ and WN.

12. A dynamic random access memory having the
5 semiconductor device according to any of Claims 7 through
11 as a basic unit.

13. An involatile memory having the semiconductor
device according to any of Claims 7 through 11 as a basic
10 unit.

14. A semiconductor device comprising:
a substrate having a transistor;
an insulating film formed on the substrate and having
15 an opening portion;
a diffusion barrier film provided in the opening
portion and connected to the transistor;
a reaction barrier film provided on the insulating
film;
20 a first electrode electrically conducted to the
diffusion barrier film;
a ferroelectric film provided on the first electrode
and including at least one element selected from the group
consisting of lead, barium and bismuth; and
25 a second electrode provided on the ferroelectric
film.

15. The semiconductor device according to Claim 14:

wherein the ferroelectric film is formed over an upper face and side faces of the first electrode.

16. The semiconductor device according to Claim 14: wherein the ferroelectric film comprises any of the group consisting of lead titanate zirconate, lead titanate, barium lead titanate zirconate, barium lead niobate, strontium bismuth tantalite, bismuth titanate and barium strontium titanate zirconate.

17. The semiconductor device according to Claim 14: wherein the reaction barrier layer comprises any of the group consisting of titanium oxide, alumina and bismuth silicate.

18. The semiconductor device according to Claim 14: wherein the diffusion barrier film is a film comprising any of or laminated with any of the group consisting of Ti, Ta, TiN, $Al_xTi_{1-x}N$ and WN.

19. A dynamic random access memory having the semiconductor device according to any of Claims 14 through 18 as a basic unit.

20. An inviolable memory having the semiconductor device according to any of Claims 14 through 18 as a basic unit.

21. A method of fabricating a semiconductor device, said method comprising:

a step of forming an insulating film having an opening portion on a substrate having a transistor;

5 a step of filling a conductive film in the opening portion;

a step of forming a reaction barrier film functioning to prevent a reaction on the insulating film;

10 a step of forming a diffusion barrier film on the conductive film;

a step of forming a first electrode on the diffusion barrier film;

15 a step of forming a ferroelectric film including at least one element of the group consisting of lead, barium and bismuth on the first electrode after the step of forming the reaction barrier film; and

a step of forming a second electrode on the ferroelectric film.

20 22. The method of fabricating a semiconductor device according to Claim 21:

25 wherein the diffusion barrier film is formed by forming the reaction barrier film on the insulating film and the conductive film, removing the reaction barrier film on the conductive film and embedding the diffusion barrier film in a region removed of the reaction barrier film.

23. A method of fabricating a semiconductor device,

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said method comprising:

51 a step of forming an insulating film having an opening
portion on a substrate having a transistor;

52 a step of filling a conductive film in the opening
portion;

53 a step of forming a reaction barrier film functioning
to prevent a reaction on the insulating film;

54 a step of forming a diffusion barrier film on the
conductive film after the step of forming the reaction
55 barrier film;

56 a step of forming a first electrode on the diffusion
barrier film;

57 a step of forming a ferroelectric film including at
least one element of the group consisting of lead, barium
62 and bismuth on the first electrode; and

63 a step of forming a second electrode on the
ferroelectric film.

68 24. The method of fabricating a semiconductor device
69 according to Claim 23:

70 wherein the diffusion barrier film is formed by
71 forming the reaction barrier film on the insulating film
72 and the conductive film, removing the reaction barrier film
73 on the conductive film and embedding the diffusion barrier
74 film in a region removed of the reaction barrier film.

79 25. A method of fabricating a semiconductor device,
80 said method comprising:

a step of forming an insulating film having an opening portion on a substrate having a transistor;

a step of filling a conductive film in the opening portion;

5 a step of forming a reaction barrier film comprising
an oxide on the insulating film;

a step of forming a diffusion barrier film on the conductive film;

a step of forming a first electrode on the diffusion barrier film;

a step of forming a ferroelectric film including at least one element of the group consisting of lead, barium

and bismuth on the first electrode; and
a step of forming a second electrode on the

26. The method of fabricating a semiconductor device according to Claim 25:

wherein the diffusion barrier film is formed by forming the reaction barrier film on the insulating film and the conductive film, removing the reaction barrier film on the conductive film and embedding the diffusion barrier film in a region removed of the reaction barrier film.

27. The method of fabricating a semiconductor device according to Claim 25:

wherein the step of forming the reaction barrier film comprises a step of forming a metal film and a step of

oxidizing the metal.

28. The method of fabricating a semiconductor device according to Claim 25:

5 wherein the step of forming the reaction barrier film is a step of forming the reaction barrier film by any of a reactive sputtering method in an oxygen including atmosphere, a CVD process and a sol/gel coating process.

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